

Methods of Analysis for Maple Sirup: USDA Color Comparator*

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Table maple sirup, to be classified according to state standards, must meet certain minimum requirements of density and cloudiness; must possess a characteristic maple flavor; and must be clean, free of fermentation, and free of damage caused by scorching, buddyness, and any objectionable flavor or odor. After meeting these requirements it is classified according to its color into one of four grades: U.S. Grade AA, U.S. Grade A, U.S. Grade B, and Unclassified.

For the past several years the colors (grades) of sirups have been determined by the use of a simple color comparator de-

veloped by the United States Department of Agriculture (1, 2). The comparator is equipped with three permanent colored glasses designated as Light Amber, Medium Amber, and Dark Amber, which serve as color standards when maple sirup is viewed through a 1.24 inch layer. To obtain this thickness of sirup layer the sirup sample is placed in a selected square 2-ounce bottle having an internal thickness of 1.24 inch. A sirup judged equal to or lighter than the Light Amber standard (i.e., no redder than the Light Amber standard) is assigned U.S. Grade AA (Vermont Fancy, New York Fancy). If it is redder than the Light Amber standard but not redder than the Medium Amber standard it is judged U.S. Grade A (Vermont A, New York No. 1). If it is redder than the Medium Amber standard but not redder than the Dark Amber stand-

* Presented as the report of the Associate Referee on Maple Products, C. O. Willits, at the Seventy-fourth Annual Meeting of the Association of Official Agricultural Chemists, Oct. 10-12, 1960, Washington, D.C.

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ard it is judged U.S. Grade B (Vermont B, New York No. 2). If it is redder than the Dark Amber standard it is judged U.S. Unclassified (Vermont C, New York No. 3).

The quality of maple sirup in general coincides with its color grade; the lightest is the best or top quality. In general, it has been the practice for sirups sold for reprocessing, and more recently for those sold retail, to have a price differential of thirty to fifty cents per gallon between adjacent grades. Thus it is imperative that the color (grade) of sirup be precisely established especially when the sirup has a color that is close to an adjacent grade. Any error in judging the color (grade) may result in a financial loss.

A collaborative study was conducted this year to determine whether or not the comparator containing the permanent glass color standards for maple sirup established by the United States Department of Agriculture permits making color judgments of maple sirups of the desired accuracy.

Six samples of pure maple sirup were prepared whose colors, when viewed through the standard 1.24 inch layer, had been adjusted close to but having slightly more or less red than the colors of the three master glass color standards. These samples were made by mixing U.S. Grade AA sirup with different amounts of sirup of other grades (colors). Aliquots of these six different colored sirups were put in selected 2-ounce square bottles having an internal dimension of 1.24 inch as specified for use in the maple sirup color comparator. A complete set of the six sirups was sent to 14 collaborators. The collaborators were instructed to judge the color of the sirups by the USDA maple sirup color comparator which is fitted with glass standards duplicating the colors of the master standards within established tolerances corresponding to about ± 1.9 mm on the Pfund color scale. The 2-ounce square bottle filled with maple sirup to be classified was placed in compartment 2 or 4 of the comparator and compared with adjacent standards. A natural or artificial daylight source of light was employed and the comparator was held 12 to 18 inches from the eye.

Judgments were made on three different

days so that each collaborator made at least 3 judgments of each sample. In addition, the collaborators were asked to invite others in their organization to make similar judgments. This resulted in more than 100 ratings of each of the six samples in this study. The results are given in Table 1.

For purposes of comparisons and evaluation of the data the chromaticity of the six sirup samples and the equivalent of the three master glass color standards in terms of chromatically matched sirups have been expressed in scale readings for the nearest chromaticity match on a calibrated Pfund color grader, a wedge comparator used for grading honey (3, 4). The Light Amber color standard had a scale value of 37.5 and the color of U.S. Grade AA ranged from 0 to 37.5.

The medium amber standard had a scale value of 57.6 and the medium amber range was from 37.5 to 57.6 or 20.1 units. The dark amber standard had a scale value of 79.7 and the dark amber range was from 57.6 to 79.7 or 22.1 units. The Pfund scale values for samples B, C, D, and F were 54.2, 64.0, 66.5, and 91.2, respectively. All were sufficiently different in chromaticity from the standard glasses to enable the judges to classify them correctly.

The judges did have some difficulty in judging samples A and E since there were 25 misses out of 104 judgments of A and 45 misses out of 104 judgments of E. This was to be expected since the chromaticity of both of these samples was less than one Pfund scale unit (1 mm) different from settings corresponding to the master standards. This is a smaller difference than the established tolerance of about ± 1.9 mm for the colored glass standards of the commercial comparators and the master color standards. However, even with these samples the majority of the judgments were correct; further, the probable number of samples encountered having a chromaticity this close to that of the glass standards is relatively small.

Therefore, this 1960 collaborative study has shown that it is possible to satisfactorily classify maple sirup for color with the official USDA color comparator. Errors and diffi-

Table 1. The collaborative judgments of colors of six maple sirups by the U.S.D.A. approved maple color grader

Sample	Color	Scale ^d Reading	Number of Judgments						
			Trial 1		Trial 2		Trial 3		
			Correct	Incorrect	Correct	Incorrect	Correct	Incorrect	
LA ^a	LA	37.5	—	—	—	—	—	—	104
A	MA	38.2	27MA	9LA	26MA	8LA	26MA	8LA	
B	MA	54.2	36MA	—	34MA	—	34MA	—	
MA ^b	MA	57.6	—	—	—	—	—	—	
C	DA	64.0	36DA	—	34DA	—	32DA	2MA	102
D	DA	66.5	35DA	1MA	33DA	1MA	34DA	—	
E	DA	79.2	22DA	14	18DA	16	19DA	15	
				Unclass.		Unclass.		Unclass.	
DA ^c	DA	79.7	—	—	—	—	—	—	104
F	Unclass.	91.2	36	—	34	—	34	—	
			Unclass.	—	Unclass.	—	Unclass.	—	

^{a, b, c} Samples of maple sirup adjusted to yield a chromaticity match (when viewed through a layer of 1.24 inch) with the respective glass color standard.

^d Scale reading for the nearest chromaticity match on the Pfund color grader (a wedge comparator used for grading honey).

culties may be encountered when the color of the sample is very close to that of a glass color standard of the comparator. These errors could be minimized by special procedures involving the use of precision cells, standardized light sources, and selected glass standards.

Recommendation

It is recommended¹ that the use of the USDA color comparator for classifying maple sirup be adopted as first action.

Acknowledgment

The Associate Referee wishes to express his appreciation to the following collaborators and their associates for making this study possible:

R. G. Coombs, Jr., Coombs Maple Products, Jacksonville, Vt.;

Augustus Conlin, American Maple Products Inc., Newport, Vt.;

Fred Dunn, Processed Products Standardization and Inspection Branch, Fruit and Vegetable Division, U.S. Department of Agriculture, Washington 25, D.C.;

Kirby M. Hayes, Extension Food Technologist, Department of Food Technology, University of Massachusetts, Amherst, Mass.;

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¹ This recommendation was approved by the General Referee and by Subcommittee D, and was adopted by the Association. See *This Journal*, 44, 74 (1961).

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